Perceptual and Motor Skills, 1978, 46, 423-426. © Perceptual and Motor Skills 1978

NO EVIDENCE FOR RELATIONSHIP BETWEEN BIORHYTHMS AND INDUSTRIAL ACCIDENTS

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Summary.—According to the popular biorhythm model accidents are more likely to occur during the "critical days" of three sine wave-like cycles that display periodicities of 23 days, 28 days, and 33 days. Analyses of 400 mining accidents from two separate industries demonstrated that the number of employees who were involved with accidents on their individual critical days of the different cycles did not differ significantly from chance expectancy. Furthermore the number of employees involved in accidents when their cycles were in ascending phases (presumably associated with positive behaviors) did not differ significantly from the number of employees who were involved in accidents when their cycles were in the descending phases, presumably associated with negative behaviors. We have found neither empirical nor theoretical support for the biorhythm model.

Prediction of human behavior by the biorhythm model has been claimed by a variety of authors (e.g., Thommen, 1968; Mallardi, 1977) and has been given frequent publicity by the popular media. According to this concept, a rigid triad of sine wave-like periodicities with wavelengths of 23 days (the physical cycle), 28 days (emotional cycle), and 33 days (intellectual cycle) start at birth and continue unaltered throughout a person's life. Half the days of each cycle, i.e., 12½ days, 14 days, 16½ days, are above the horizontal axis, the ascending phase or "up" days, while the other days are below the axis, the descending phase or "down" days. Positive behaviors associated with each cycle presumably occur more frequently during the up days while negative or undesirable behaviors occur more frequently during down days. The days upon which the rhythms cross the axis are called "critical days" during which time accidents and related behaviors are supposed to be more probable. There are two critical days for each cycle (Thommen, 1968).

Popular claims have been made that traffic and industrial accidents are more likely to occur during a person's critical days and that the biorhythmic model can be used to prevent these incidents. Although significant financial gains have been made by companies selling biorhythmic apparatus, the "proofs" of these cycles are based upon heresay evidence or upon experiments that have not controlled for Hawthorne or expectancy effects within the population studied. Many of the popular claims are denied by the companies allegedly involved with biorhythmic programs (Katz, 1977). Some authors (Dale, 1976) confuse the issue further by failing to discriminate between biorhythms

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and biological rhythms. The latter phenomena are based upon clear empirical grounds and have been demonstrated repeatedly to display highly variable periodicities depending upon a multitude of environmental stimuli.

Although the validity of the biorhythm concept appears unlikely *a priori*, the critical test must lie within empirical examination. Such testing can be considered imperative when questionable phenomena such as biorhythms, supported by promotional rather than by more objective evaluations, are offered to the populace as simple guides and predictors for complex human behaviors. Other experimeters (Fix, 1976; Whitton, 1977) who have attenuated the problems of expectancy effects have found no evidence for biorhythmic contentions. However, these studies did not involve accident data. Since, according to biorhythmic prediction, accidents are more likely to occur on critical days, we decided to test this prediction by analyzing 400 mining industrial accidents.

METHOD

A total of 400 accidents was selected from two local mining industries (I and F). The 200 accidents from Industry I occurred between July and October, 1972, while the 200 accidents from Industry F occurred between February and June, 1974. Cases involved both time-off and medical aid conditions and surface as well as underground accidents. The average ages of the groups of men were 32 and 35 yr. and ranged between 23 and 45. For comparison purposes, the accidents were statistically analyzed in 4 groups of 100 accidents each.

Both (1) the number of days between the accident day and the nearest critical day and (2) the location of the individual in an ascending ("up") phase or descending ("down") phase on the day of the accident were calculated for each cycle for each subject. The arithmetics of these calculations, which assume that the 23-, 28-, and 33-day cycles begin at 0 at birth, have been described by Thommen (1968). Biorhythmic cycles for subjects from Industry I were calculated manually by J.J. while cycles for subjects from Industry F were plotted by computer and analyzed by M.A.P. and W.C.

The numbers of accidents expected to occur by chance on the critical days of each cycle for the populations of 100 subjects (accidents) were assumed to be $2/23 \times 100$ for the physical cycle, $2/28 \times 100$ for the emotional cycle and $2/33 \times 100$ for the intellectual cycle. To allow some lateral variability of the critical day effect, other calculations included the number of accidents occurring on the day before and after the critical day, i.e., critical day $\pm$ 1 day. In this situation chance was assumed to be the above calculations multiplied by 3. Since half the number of days of each cycle are "up" or "down" days, one would expect in a random population 50% of the accidents occurring when the subjects were in either the "up" or "down" phase.

Results and Discussion

The numbers of employees that displayed "critical days" according to biorhythmic calculations at the time of the accidents for each cycle are shown in Table 1 for each of the four analysis groups. The numbers in parentheses indicate the number of subjects whose accidents occurred on a critical day and within either one day before or after the critical day. The numbers of accidents expected to occur by chance alone on critical days or within 3 days (in parentheses) are also shown. Chi-square analyses demonstrated that the number of employees involved with accidents on their individual critical days did not

TABLE 1

Number of Employees Whose Accidents Occurred On Their Critical Days or Within 1 Day (Critical Day ± 1 Day) of Critical Days

Source	*N*	Physical	Emotional	Intellectual
Industry I				
Sample 1	100	9(27)	8(21)	6(19)
Sample 2	100	10(25)	8(26)	8(19)
Industry F				
Sample 1	100	11(20)	9(24)	5(11)
Sample 2	100	6(29)	5(17)	6(19)
Chance Expectancy	100	9(26)	7(21)	6(19)

differ from chance for any of the cycles. The numbers of subjects that were in ascending phases (upper half) or descending phases (lower half) for each cycle at the time of the accident are presented in Table 2 for the four analyses groups. Chi-square analyses indicated that accidents were not more likely to occur in either phase in any of the three cycles for the analyses groups.

These data do not support any of the basic biorhythmic predictions. Mining accidents which involved both surface and underground events were not more likely to occur on critical days, around critical days, or during descending

TABLE 2

Number of Employees Who Were in Ascending Phases (+) or Descending Phases (−) of Three Cycles On Days of Accidents

Sample	Physical		Emotional		Intellectual	
	+	−	+	−	+	−
Industry I						
Sample 1	45	55	43	57	40	60
Sample 2	50	50	47	53	53	47
Total	95	105	90	110	93	107
Industry F						
Sample 1	46	54	55	45	45	55
Sample 2	57	43	50	50	49	51
Total	103	97	105	95	94	106

("down") portions of the various cycles. In addition to the absence of supporting data, the implicit assumptions of biorhythms are questionable. There have been no experiments clearly demonstrating the presence of unalterable and long-term 23-day, 28-day or 33-day cycles in human organisms. The periodicities that are known, such as the circadian and menstrual rhythms, are subject to cycle-length variations and marked environmental influence.

Rigid, unalterable 23-day, 28-day, and 33-day periodicities, beginning at birth, are central to biorhythmic contentions. However, if the 23-day cycle were extended (and maintained) by 10 min. when a subject was 5 yr. of age, the prediction of a person's position in that cycle 20 yr. later would be inaccurate by 2.21 days. A glaring discrepancy in the 'theory' involves the lack of mortality or accident proneness in the population in general when a person is 58 yr. and 66 or 67 days of age during which time all three cycles presumably cross the origin of the biorhythmic axis in the same direction (a "triple critical day").

No doubt further theoretical criticisms of biorhythms would be tantamount to shooting a unicorn. However, the concerned scientist confronted with the many forms of pseudoscientific and unsubstantiated claims is faced with a dilemma. Investigation of such claims is likely to be fruitless, but the avoidance of the problem allows poorly collected data and erroneous interpretations to remain as the only information available. Our analyses demonstrated no support for the several predictions generated from the biorhythm model.

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Accepted January 31, 1978.